REMARKS

In the Office Action, the examiner rejected Claims 1-4, 6-15 and 17-18 under 35 U.S.C. 103(a) as being unpatentable over Mori (U.S. Patent No. 4,325,664 in view of Reed (U.S. Patent No. 3,586,664) and the Machinery's Handbook. Accordingly, the applicant has amended the claims to more clearly differentiate the present invention from the technologies disclosed by the cited references. More specifically, the applicant has added the limitations that (a) the arbor has a pair of driving slots formed in an outer circumferential surface of the annular flange portion, (b) the relative-rotation preventing mechanism is configured by three receiving holes and three pins where each pin formed on the contact surface of the arbor is fitted in the corresponding receiving hole, (c) the three pins are equally spaced from an axis of the arbor and equally apart from one another in a circumferential direction of the arbor, and (d) the three pins are positioned relative to the pair of driving slots such that one of the pins is farthest from the driving slots and two remaining pins do not overlap with the pair of driving slots as seen in an axial direction of the cutting tool assembly. The applicant has added the limitations similar to that of Claim 1 noted above to independent Claims 9 and 14. The applicant has canceled Claims 2, 6, 8, 12-13 and 17-18.

The newly added limitations are supported by Figs. 1A and 1B as well as the descriptions at paragraphs 39, 40 and 59. The

applicant has amended the specification in the paragraphs 40 and 59 to describe the positional relationship between the driving slots and the three pins shown in Fig. 1B. The three pins which fit in the corresponding three receiving holes are shown in Figs. 1A and 1B and the three receiving holes are shown in Figs. 2A and 2B.

As noted in the previous response to the office action, in the present invention, the cutting tool assembly has a weight of not larger than 3 kg and a spindle nose size of No.30, the cutting tool is a face milling cutter having a cutting diameter of 80-160 mm, and the relative-rotation preventing mechanism has receiving holes and protrusions to engage with one another where an inner shape and size of said receiving hole is substantially identical to an outer shape and size of the protrusion. In addition, as noted above with respect to the newly added limitations, the essential features of the present invention further include that (1) the arbor has a pair of driving slots formed in an outer circumferential surface of the annular flange portion, (2) the relative-rotation preventing mechanism is configured by three receiving holes and three pins where each pin formed on the contact surface of the arbor is fitted in the corresponding receiving hole, (3) the three pins are equally spaced from an axis of the arbor and equally apart from one another in a circumferential direction of the arbor, and (4) the three pins are positioned relative to the pair of driving slots such that one of the pins is farthest from the driving slots and two remaining pins do not overlap with the pair of driving slots. Because of

these features, it is possible to reduce the weight of the cutting tool assembly without reducing the rigidity for permitting a cutting tool of a large cutting diameter 80-160 mm in a small-sized machine tool with a spindle nose having a size of No. 30. These essential features of the present invention are not shown or suggested by the cited references as discussed below.

The cited Mori reference discloses a cutting tool in which the cutter can be easily detached from the arbor head and yet is prevented from slipping out of the fingers of the worker. The cutting tool in the cited Mori reference is to solve the disadvantage of the conventional cutting tools which arises when removing the cutter from a vertical type milling machine. Because the bolt has to be unscrewed with one hand of the worker with the cutter supported with the other hand, the cutter 3 may slip out of the fingers of the worker.

To solve the problem noted above, the cutting tool disclosed by the cited Mori reference includes, among others, a collar 14 fitted on the shank of the bolt 12. The periphery of the collar 14 is provided with two enlarged portions (outward flanges) 15 which are symmetrical about the axis of the collar 14. A cutter 21 of the cutting tool is provided with a ring 24 which serves as an inward flange. Two pins 27 are provided on the end surface of the arbor head which faces the cutter 21 and two arcuate grooves 29 are provided on the surface of the cutter 21 so that the pins 27 are inserted in the arcuate grooves 29.

In order to mount the cutter 21 on the arbor head 10, the collar 14 passes through the ring 14 and each of the pins 27 fits in the arcuate groove 29 in such a manner that the pin 27 is positioned at one end 30 of the arcuate groove 29. Then the cutter 21 is turned until each of the pins 27 comes in contact with the other end 31 of the arcuate groove 29. As a result, the two enlarged portions 15 engages with the ring 14 so that the cutter 21 will not drop from the arbor head 10.

The cited Mori reference does not show or suggest the specific structure of the cutting tool assembly of the present invention to achieve the light weight, large cutting blade, and high rigidity. As noted by the features (2)-(4) above, the relative-rotation preventing mechanism is configured by three receiving holes and three pins where each pin is fitted in the corresponding receiving hole. Because the outer shape of the pins and the inner shape of the receiving holes are identical, the cutting tool is attached to the arbor when the three pins are press-fitted in the receiving holes without play.

In contrast, the cutting tool of the cited Mori reference includes a pair of arcuate grooves 29 to receive the pair of pins 27 which allow the rotation of the cutter about 45 degrees. The cutter 21 is finally fixed to the arbor by tightening the screw 28. Because the position of the pins 27 have to be adjusted and tightened by the user, displacement or play of the cutter 21 tends to occur. Further, because the arcuate grooves 29 are relatively

long, the rigidity of the cutting tool is impaired. To maintain the rigidity, the volume of the material of the cutting tool has to be increased. This requirement teaches away the present invention in which the weight of the cutting tool assembly is reduced without reducing the rigidity.

Further, in the present invention, the three pins are equally spaced from an axis of the arbor and equally apart from one another in a circumferential direction of the arbor. The three pins are positioned relative to the pair of driving slots such that one of said pins is farthest from said driving slots and two remaining pins do not overlap with the pair of driving slots. The cited Mori reference shows two pins 27. Therefore, the specific positional relationship between the three pins and the pair of driving slots is not shown or suggested by the cited Mori reference.

The cited Reed reference discloses a spindle assembly 10 for mounting a tool adapter 11. The assembly 10 includes a spindle 12 journaled by bearings 13 in a sleeve 14 that can be translated linearly in a headstock 15. The end of the spindle 12 is formed with a tapered socket 16 surrounded by a power chuck 17 that includes four jaws 18 and an annular actuating piston 19. Hydraulic pressure in a chamber 21 forces the piston 19 downwardly and thus actuates the jaws 18 inwardly.

The tool adaptor is formed with a tapered shank 31 proportioned to meet within the socket 16, an annular gripping ridge 32 which cooperates with the jaws 18, and an annular tool

support flange 33. A tool 34 is secured to the end of the tool adapter 11. The tool adapter 11 also includes external gearlike clutch teeth 35 which, when the flange 33 abuts the drive plates 25, closely interfit with the teeth 26 and thus positively couple the tool adapter 11 for rotation with the spindle 12. The flange 33 supports the adapter 11 in a tool matrix and provides the portion of the adapter which is engaged by tool transfer devices.

A plurality of pins 40 are fixed on the flange 33 and disposed angularly about the flange axis so that the adapter 11 can be nontiltingly supported on the ends of the pins 40, and holes 41 are formed in the drive plate 25 to receive the pins 40, the pins and holes being arranged so that they interfit in only one angular position of the adapter 11 relative to the spindle 12.

As noted above with respect to the feature (1) above, the arbor has a pair of driving slots formed in an outer circumferential surface of the annular flange portion. Apparently, the spindle assembly of the cited Reed reference does not have the pair of driving slots. Thus, the essential feature (1) of the present invention is not shown or suggest by the cited Reed reference. Further, with respect to the feature (2) of the present invention, the three pins are formed on the contact surface of the arbor. In contrast, in the spindle assembly of the cited Reed reference, the pins 40 are formed on the flange of the tool adaptor, i.e., cutting tool, rather than the arbor. Thus, the

essential feature (2) of the present invention is not shown or suggest by the cited Reed reference.

As discussed above, since the essential features of the present invention are shown or suggested by the cited references, the present invention defined in the claims is not obvious over the cited references taken singly or in combination. Thus, the applicant believes that the rejection under 35 U.S.C. 103(a) is no longer applicable to the present invention.

In view of the foregoing, the applicant believes that the instant application is in condition for allowance, and accordingly, the applicant respectfully requests that the present application be allowed and passed to issue.

Respectfully submitted,

MURAMATSU & ASSOCIATES

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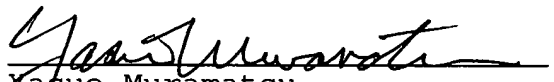
By: 

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